LAMINECTOMY FOR POTT'S PARAPLIGIA.[1]

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IN view of the interest excited among surgeons by the possibility of the operative treatment of many spinal lesions it may be interesting as well as instructive to publish the result of my tabulation of cases of removal of the spinal arches in Pott's paraplegia.

Naturally the suggestion of operative interference with these lesions comes as a startling suggestion to those not personally accustomed to the brilliant results following the surgical invasion of the other cavities of the body, but the growing tendency among all classes of observers to recognize the fact that while theoretically abscesses may be produced and continued by non-pyogenic influences, they never exist in this condition clinically, settles more definitely than formerly the question of treatment. Whether the presence of the bacilli is due to the general systemic inoculation or not, the fact remains that when abscesses are examined microbes are generally present.

Undoubtedly it is a fact, as has been demonstrated by Shaffer, that many abscesses in Pott's disease run a benign course, but it has also been demonstrated histologically as well as clinically that an encysted abscess, even though the microbes themselves have succumbed, is a constant menace not only to the integrity of the parts originally invaded but also to the general health of the individual. The recognition of this fact then has led to the surgical axiom that all pus should be evacuated.

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[1] Read in part before the Orthopædic Section of the New York Academy of Medicine, Feb. 20th., 1891.

In carrying out this principle different operators have gone to different lengths, some suggesting that the abscess should only be incised at the level where pointing occurs, while others insist that it should be followed up and opened at the level nearest to the original focus of disease. From the disastrous results of operative procedures upon abscesses connected with the spine in pre-Listerian days it is not surprising that many whose experience dates back to that time should either decry operation absolutely or advocate as little operative interference as possible. From the very condition of things, however, no psoas or iliac abscess can be successfully treated where the opening is only made at the most dependent point. It invariably takes its origin from a bony nucleus and suppuration will continue as long as the eroded bone remains as a nidus for the suppurating process. Its fistulæ are long and tortuous, and they are dilated here and there into independent abscess cavities, which alone would be sufficient to continue the disease for an indefinite period. It is in this long continued suppuration that the danger exists for here there is a constant opportunity for fresh microbic infection without the exercise of extreme care on the part of the surgeon. This infection was undoubtedly responsible for the unfortunate condition observable formerly wherever these suppurating tracts opened externally either by natural or artificial means. At the present time, however, when surgeons are constantly attacking recognized tubercular and septic abscesses and securing union by primary intention, often without recourse to drainage, and in a period of time measured by two or three days or a week instead of the long period covered by the other methods this growing tendency to treat even spinal lesions by the knife is no longer surprising.

It becomes the rule then with the advocates of this method of treatment to follow up sinus after sinus, incise where it comes nearest to the skin, then follow it up again until the point of origin is reached, and the cause removed or proper drainage, lavage and injection instituted.

Burrell, says,[1] "although the appearance of an abscess in Pott's disease may be considered simply an incident in the course of the disease, yet it is a very serious affair unless it is properly treated, and in many of our patients in spite of all our care it is the beginning of the end; for where an abscess opens and sepsis occurs, unless great care is taken, a fatal ending is inevitable."

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[1] *Medical News*, 1891, vol. ix. p. 675.

Abscess has been found to be almost the rule in Pott's disease. As we are not apt to have caries of the bone in other parts of the body without abscess, the same is undoubtedly true in the spine. It has been found too that abscess has been present in several cases where it was not suspected during life. It simply goes on as an pre-vertebral lesion and is not recognised until it has dissected away the tissues and burrowed its way up to or through the external coverings. Thus in the present series of cases, although abscess is not referred to in twenty-five of the cases, the nature of the lesion indicates its presence in the majority. In thirty-six it is definitely stated that it was present. In only seven is it certain that it was not a part of the lesion. Of these thirty-six cases in which we have the exact statement to depend upon sixteen were cured, three were unimproved and seventeen died. In these last twenty cases one died of empyema from perforation of the pleura during the removal of a carious rib, seven were not relieved from the suppurative disease, while four were free from all signs of abscess up to the time of their death. In the sixteen noted as cured only two suffered a recurrence of the abscess and then apparently only slight suppuration in the cicatrix.

It is interesting to note that in these cases ten had abscess within the spinal canal pressing more or less upon the cord and constantly threatening an extension of the disease by gravitating downward, leaving a septic meningitis in its track. Eighteen had disease in the bodies of the vertebræ and in many of these perforation had taken place into the spinal canal and pressure was exerted on the cord by the abscess and the caseous material surrounding it. In only five of the cases were the arches involved and in one there was both an extra and a sub-dural abscess.

It was for the relief of these suppurating foci in the lumbar region that Mr. Treves,[1] in 1884, suggested an operation whereby he was able to reach and remove foci of disease on the anterior face of the lumbar vertebræ, and a number of other operators have traced abscess cavities from the lumbar region upwards. In one case operated upon by Delorme[1] the suppurating tract led as high as the level of the fourth dorsal, although the bony lesion was on the anterior surface of the body of the eleventh dorsal vertebra. It was reached by resecting a portion of the twelfth rib and the diseased bone was scraped away, the patient making a satisfactory recovery.

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[1] Med. Chir. Transactions, vol. lxvii, p. 113.

Boeckel,[2] in 1882, resected a portion of the third rib for caries and discovering a mass of flabby granulations leading towards the spine passed his finger along the track into the posterior mediastinum where he felt the eroded bodies of two vertebræ, probably the second and third dorsal, and a cavity of about the size of a small nut filled with pus and bony detritus. This was cleaned out with a spoon and at the end of five months his patient had made an almost complete recovery. Grünbaum[3] has also removed a portion of the body of the tenth dorsal vertebra with a curette. Israel,[4] also in 1882, opened an abscess leading under the twelfth rib which was rough and denuded of periosteum. On resecting this he found that the corresponding articular portion of the twelfth vertebral body was carious and presented a cavity filled with bony detritus, caseous granulations and pus. This cavity was scraped out and an opening made posteriorly exposing the spinal canal and giving vent to pus. This latter opening was then enlarged and a part of the body of the twelfth dorsal vertebra and the intervertebral cartilage between it and the first lumbar were removed. The membranes were forced to the left and flattened. After the operation the fever ceased, but the paraplegia was not improved up to the time of the patient's death, which occurred thirty-seven days later of empyema of the right side caused by a perforation of the pleura in the neighborhood of the carious rib. Abbe has also removed the transverse process and a portion of the body of the twelfth dorsal vertebra with success.

In cases where abscesses are present it is a comparatively safe procedure to explore the bodies of the vertebræ on their anterior surface, and the approach to these foci of disease is rendered easy by the abscess track, which having already established an escape for itself has pushed the intervening structures out of the way. This is not true, however, in the other cases, and the technical difficulties of Treves' operation make an approach to a diseased area when an abscess has not extended far from the point of origin exceedingly serious. Chipault,[1] however has applied the method in one case but he emphasizes the difficulties of the undertaking. When an abscess has formed, on the other hand, in addition to the fistula leading towards the diseased centre, there is usually more or less protection afforded by nature to the contiguous structures, either by an exudation of lymph, or by local inflammatory thickening of the pleura or peritoneum, so that the operative measures essential to the removal of the sequestrum or caries is much facilitated and rendered less dangerous. In these cases, therefore, where an abscess has established an opening for itself in the lumbar region or where it is pointing in this region, I can see no reason why the present surgical axiom of evacuating pus whenever it is certainly made out should not be applied, with the further procedure of exploring the abscess for the supposed bony focus and finally removing this suppurating centre, cleansing the abscess walls and attempting to bring the whole region to the condition of a surgical wound. This would enable us to cut short the disease, to remove the septic dangers and to place the patient in a better condition to recover his health and strength.

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[1] Arch. de Med. et de Phar. Militaires, 1887, Vol. I., p. 51.

[2] Gaz. Hebd., March 17, 1882, p. 171.

[3] Centralblatt f. Chir., 1889, No. 7, p. 125.

[4] Berlin klin. Wochens., 1882, No. 10.

Chipault[2] has given the subject of Treves' operation considerable attention and his paper merits a careful reading.

I have lately found it necessary to apply this technique in the case of a boy in my service at the Randall's Island Hospitals who had a marked kyphosis in the dorso-lumbar region, over which an immense tubercular tumor had developed. He had sinuses everywhere, one at the end of the coccyx, several in the thigh, due to a psoas abscess one in the side at the crest of the ilium, and one on each lateral margin of the tumer. He was rapidly growing worse, and I finally decided to do Treves' operation. The tumor of the back was very vascular, and all hope of being able at that sitting to remove it as well as to get down on, and drain the osseous focus of disease was abandoned, and the latter being considered the more urgent condition for treatment attention was at once directed to the sinuses. Those on the thigh were incised and followed up until a large sized drainage tube could be passed through them. The sinus at the crest of the ilium was found not only to have an external opening but a fistula communicating with the one on the lateral face of the same side of the tumor, and it also dipped down along the inner side of the ilium and communicated with one in the thigh. These were both sufficiently enlarged by careful dissection to allow of thorough irrigation and packing with iodoform gauze. The lateral sinus on the left side was then taken in hand and Treves' incision was made, keeping the fistula as the centre of the incision. It soon led into a prevertebral abscess of the size of a fist containing a large quantity of granular debris and several sequestra ranging in size from a crab-apple down. These were removed and the denuded and carious vertebral bodies were scraped out. The sinus on the other side was then treated in the same way and found to communicate with the same cavity, and it was demonstrated that the coccygeal sinus also took its origin from this source. The improvement has been considerable, and this patient will soon be able to wear a brace, a a thing that was formerly impossible, owing to the presence of so many *fistulous* openings.

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[1] Revue de chirurgie, Nov. 1891.

[2] Arch. gen. de med., Oct., Nov. and Dec., 1890.

Since the appearance of the brochure on Surgery of the Spinal Cord by W. Thorburn in 1889, in which he reported eleven cases of operation for disease, the number has increased to seventy-five. His table did not include the case of Israel which should be tabulated inasmuch as it was a posterior opening of the spine and an excavation of the posterior surface of the body of a vertebra.

There can be no doubt that Chipault is theoretically correct when he says that the essential consideration in spinal surgery is first " to remove the diseased bony point, that is, to carry out the general surgical idea in regard to tuberculosis of bones," and second, " to relieve the cord from compression, whether by a sequestrum, an extra spinal abscess, or more often by tubercular granulations arising from an external pachymeningitis ; " but more practical considerations based upon clinical experience must lead to decided limitations in the application of the method.

The age of the patient is an important consideration. In the seventy-five cases forming the basis of this paper, twenty were adults and thirty-nine children. In the other cases the age was not noted. Thirteen of the adults died. One, Deaver's (No. 23 in our table), from respiratory troubles due to inhibition of the phrenic nerves by exploratory puncture of the cord at their point of origin. Another, Israel's (No. 5), after 37 days of an empyema, due to puncture of the pleura during the resection of the carious rib, before opening the spine; and a third, one of Kraske's[1] (45), lived eight weeks, although the autopsy revealed the fact that the compression had not been removed.

One of Lane's cases (35), having fully recovered from the effects of the operation, died nearly two years later of pulmonary phthisis never having had the slightest return of the spinal symptoms.

In one of Kraske's (48) a recurrence of the disease was noted seven months after the operation, and the autopsy revealed the fact that the spinal symptoms were due to a re-invasion below the site of the former operation which was perfectly healed. Colman's case (44) lived two months and died of exhaustion. There was no improvement in this case, owing to anterior compression which was not overcome and there was also degeneration in the cord. In Demons' case (26), too, the compression was not discovered at the time of the operation.

One of Schede's cases (61) died two and a half months after the operation of tubercular empyema and pneumonia.

In the children, 39 cases 16 deaths, Southam's[2] (11) was "apparently dying" when the operation was undertaken and was suffering from broncho-pneumonia, while two of Chipault's cases (50 and 51) died three and five weeks after the operation, also with broncho-pneumonia. The first case revealed a very extensive lesion including the bodies of the fourth, fifth, sixth, seventh, eighth and ninth dorsal vertebræ. In Schede's cases one died of exhaustion after forty-seven days (59), and another after two months (62). In one the progress of the spinal lesion was not arrested and death resulted in three months (64), while in another the autopsy showed a hopeless degeneration of the cord and a tubercular pleurisy (65). A fifth case died in collapse twenty-four hours after the operation and the autopsy revealed a purulent peritonitis (63). In my own case the operation was undertaken too late (74). I have no doubt had the spinal compression been relieved before the child was completely exhausted that she might have been cured, the decided benefit resulting from an operation that was expected to be fatal even before its termination was a proof of this fact. Phelps' case (67) died of pneumonia one month after the operation, when the spinal symptoms were progressing favorably, while one of Lane's (36) succumbed to a hemorrhage from a rectal polypus, while improvement in the paralytic symptoms was progressing satisfactorily.

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[1] *Centralblatt f. Chir.*

[2] *Brit. Med. Journ.*, vol. II., 1888, p. 665.

It has already been stated by various authorities that Pott's disease in children is decidedly less serious than in adults, and the same condition is evident in cases that have been subjected to operation.

The region also seems to exercise a considerable influence upon the prognosis.

In fifty-eight of the cases the region involved in the disease is stated. Of these fifty-three were dorsal, giving eighteen recoveries, seven improved, eight not improved and nineteen deaths. There are but five cervical cases, two of which were cured while the other three died. One case involved the cervical and upper dorsal regions and one the dorso-lumbar, and both died. In the lumbar region there is one case cured. These figures bear out the fact already noted in a former paper on Laminectomy for Traumatic Lesions of the Spine,[1] that the mortality is higher when the upper regions of the spine are invaded.

The time of the operation after the onset of the disease has varied from a few days to seven years.

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[1] *Am. Journ. Med. Sciences*, July, 1891.

These statistics show simply that there is no period better than another for operation, cures having resulted at five months and at seven years while no improvement has been noted both at six months and at three years. Still this question of when to operate if we operate at all is the most important one we have to answer. It is beyond question that the tendency of paraplegia in Pott's disease, especially in children is towards recovery, even after the lapse of considerable time and when there has been one or more relapses.

Lauenstein's[1] rule in regard to operating after six weeks if there is paralysis of the bladder and rectum and the formation and spreading of bedsores, has been proven by abundant clinical experience to be inapplicable in these cases, however well it may apply to traumatic lesions of the spine. Myers[2] in a paper read before the Am. Ortho. Asso. has reported that 55 per cent. out of a total of 218 cases of paraplegia were known to have completely recovered, and Gibney out of 58 cases reported 29 recoveries, 50 per cent. Taylor and Lovett have reported 17 recoveries out of 19 cases, and Sayre, 34 out of 38. Myers showed that the average duration of the paraplegia was in the cervical region twelve months, in the upper dorsal nine and one-half, in the lower dorsal six, and in the lumbar region eight months, but cases may recover even after a considerably longer period. These statistics do not show unfortunately whether the length of time the paraplegia has existed, has any effect upon the completeness of the recovery. It would be interesting as it is important to determine how long the spinal cord may remain compressed without the establishment of degenerative changes. In the traumatic cases an entirely different condition obtains, for the interference with the function of the cord has been sudden and severe, and usually accompanied with more or less bruising or concussion. Hence we often find a traumatic myelitis existing after the injury, which serves as an absolute contra-indication to operative interference during its continuance. In Pott's disease on the other hand the compression is gradual, unaccompanied with any sudden jarring of the cord and consequently free from the acute inflammatory

[1] *Centralblatt f. Chir.*, 1886, No. 51, p. 888.

The Prognosis of Pressure Paralysis, *Times and Register*, Nov. 29, 1890.

disturbances which so often characterize the other class. Still in some cases myelitis occurs and progresses rapidly in Pott's disease, as is well proven by Colman's[1] case (44), but it is impossible to say whether this is due to the compression or whether it may not be a part of the general inflammatory condition surrounding this portion of the cord. Page's case (54), too, in which the secondary degeneration was recognized prior to the operation may be taken as an illustration of this point. Probably both circumstances exercise a certain amount of influence.

It has been stated that degeneration takes place within six months and yet the conservative indications are that a cure may result after a much longer period. It is also always possible that the cord may become accustomed to a certain amount of compression and resume its function until an exacerbation of the disease produces an increased compression compelling a fresh adaptation of the cord to its confined space. This may account for some of the cases that relapse while under treatment by conservative methods.

Theoretical considerations must give way, however, before clinical experience, and consequently it seems impossible to definitely settle upon any time when, as a rule, operation should be undertaken. This must of necessity vary with the individual case and must be modified by the results obtained from properly adjusted conservative treatment. It is safe to say that no surgeon would interfere in any case in which there were other tubercular lesions of any extent complicating the cord lesion. Macewen[2] has considered marked hectic a contra-indication, but this is a fallacious sign, for the fever may be due to the progress of the vertebral lesion and may be immediately overcome by the operation, as was the case in Israel's patient (5) and in one of Abbe's (21).

Burrell and Bullard have said that " so long as we have reasonable or even moderate chances of recovery without operation we do not believe it advisable or justifiable, in the present condition of spinal surgery, to perform so serious an operation as the resection of the laminæ of the spinal vertebræ." Kraske says,

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[1] Lancet, Feb. 22, 1890, Vol. I, p. 402.

[2] *Brit. Med. Jour.*, 1888, Vol. II., p. 308; and 1886, Vol. I., p. 40.

" It is necessary before operating to have exhausted all other methods of treatment. I would only interfere when a paralysis of the bladder is established : this is the one symptom which is so serious as to justify everything."

It is unnecessary to say that no surgeon would undertake an operation of this magnitude where there was any chance of recovery by other means; but there still remains a considerable number of cases that occupy debatable ground, where the chances of recovery without operation are very slight, where continued mechanical treatment yields little or no result, and where at any moment an extension of the lesion may render the patient hopeless if it does not destroy his life. Such cases, in my opinion, had better be operated upon. Then, too, there is another class which show only progression of the disease in spite of all care and where an arrested degeneration is set up again, threatening the integrity of the cord. These should undoubtedly be operated upon and that operation should be undertaken early. How much regeneration we may hope for in a spinal cord we do not know. Some writers taking other nervous structures as a basis claim that it should be considerable and it is undoubtedly true that in cases of incised wounds, when the cord has been apparently injured, judging from the symptoms, regeneration has sometimes taken place and been more or less complete. But the conditions we have to deal with are not similar to incised wounds, the area of degeneration is greater and the progress of the disease is slow; there are no cleanly cut edges to come at once into apposition and allow of immediate reunion. It has also been shown in traumatic lesions that the cord does not recover its functions after a crush and so far no success has followed attempts to unite the severed ends.

Naturally these points do not cover all the conditions present in Pott's disease owing to the different circumstances contributing to produce the lesion, still they serve to illustrate the possibilities of recovery in cases where considerable portions of the cord have undergone degenerative changes.

We are consequently brought to this position. The operation should not be undertaken while there are any good chances of recovery without such interference, but it should not be postponed so long that an ascending or descending myelitis may destroy the patient's chances of recovery, and the first sign of a degeneration of the cord should indicate immediate operation.

This leaves a very hard problem for consideration without any definite means of settlement. Individual cases offer such varying conditions that each one must be debated by itself.

Of the cases in which recovery has taken place, Macewen's first (6) was treated for three years with a plaster jacket, and had at the time of operation motor and sensory paraplegia, incontinence of urine and fæces; limbs wasted and spastic. A thick connective tissue was found over the back of the dura mater. After this was removed pulsation returned and in twenty-four hours improvement was noticed. In his second case (7) practically the same conditions were noted, except that he does not state the duration of the disease, and he says that the cord seemed to be shrunken and the connective tissue mass was so adherent to the dura as to necessitate a removal of a portion of that membrane. He removed the laminæ until pulsation in the cord was noticed, a precaution which should be taken in every case if one is to be sure that the compression is entirely overcome. Horsley's first case (12) had severe caries of the second and third cervical vertebræ with complete paralysis of all four limbs. Eight days after the operation improvement began. The disease in this case only dated back eleven months. His second case (13) had complete paraplegia and pulmonary tuberculosis and had been ill for one year. At the time of the operation a bony abscess was found and improvement set in in ten days. His third case (14) had been ill for five years and was also improved. His fourth (15) of three year's standing was not improved while the fifth (16), a boy of sixteen, who had for eighteen months suffered with paraplegia was improved after the evacuation of an abscess. And his sixth (17), who for eight months was also paraplegic, showed very slow improvement in motion.

Wright's patient (19) had been ill for several months and under treatment six. There was an angular curvature in the mid-dorsal region with first paresis, then spastic paralysis, incontinence of urine and fæces, and anæsthesia as high as the level of the eleventh ribs. There was no abscess. Three prominent dorsal arches were removed revealing a "leathery substance" covering the cord which did not pulsate even after the removal of this tissue. No other constriction was found and no improvement followed either this procedure or the resection of more arches three years later. In Duncan's case (20) the disease had lasted twenty-one months, and he had an angular curvature in the mid-dorsal region with spastic paralysis, almost absolute, as high as the groin. There was also anæsthesia as high as the abdomen, but no difficulty with either the bladder or rectum. After the removal of the fourth, fifth, sixth and seventh dorsal arches the membranes were found adherent to the bone by granulation tissue which was scraped away: a faint pulsation was then observed. Improvement was noticed on the third day. Abbe's first case (21) of five month's standing, has been considered as not belonging to this class of cases, but a personal communication from him some time ago assures me that it was a case of Pott's disease and not a tumor. This patient had pain and a swelling containing pus over the tenth dorsal vertebra, hectic, partial loss of motor and sensory power in the lower limbs, partial paralysis of the bladder and rectum, and exaggeration of the deep reflexes. The pus was evacuated, and the eighth, ninth and tenth dorsal arches which were carious, were resected. A dense mass of connective tissue and detritus were scraped away from the posterior aspect of the dura. In one week improvement began. In his second case (22) there were symptoms of a considerable tubercular infection in addition to an iliac abscess, through which a probe passed to the twelfth dorsal vertebra. The transverse process of this vertebra was removed and one-half of the body was scraped away without injury to the cord. A cure resulted, although this patient has returned to the hospital once since with a sinus in the cicatrix. He is well again now, however.

In Wyeth's case (29) the disease dated back two years and a half; there was a curvature, including the fourth, fifth and sixth dorsal vertebræ and complete paraplegia and vesical paralysis, urethritis and cystitis caused by catheterization for the relief of which a supra-pubic cystotomy was performed. The dura was found to be tense beneath the right lamina of the fifth vertebra, and an intradural tubercular tumor containing pus was discovered and removed. The patient is reported to be perfectly well September 3rd, 1891. Gerster (30) in a case of long standing with complete paraplegia and difficulty in controlling the rectum and bladder, removed the laminæ of the sixth and seventh dorsal and finding an extensive, extra-and sub-dural abscess evacuated it. There was also an extensive caseation of the soft tissues adjoining the intervertebral focus in which the motor and sensory nerve roots on both sides were embedded. The transverse processes of the fifth, sixth, seventh and eighth thoracic vertebræ on the right, and of the fifth, sixth and seventh on the left side were carious, and the costo-vertebral articulations were destroyed; these, together with the heads of the corresponding ribs, were removed. The bodies of the sixth and seventh vertebræ, which were much disintegrated, were scraped out. There was no improvement, until after three months when it began and progressed rapidly. Dercum and White's patient (25) had complete paraplegia and anæsthesia below the nipples, girdle pains, exaggerated reflexes, a bed-sore, and pain over the third and fourth dorsal vertebræ which had continued for ten months. The laminæ of the first, second, third, fourth and fifth dorsal vertebræ were removed and adhesions between the dura and the cord were broken up. The pain was relieved at once and he began to improve the next day. In Lane's second case (33) the disease had continued for two years and there was analgesia of both sides, almost complete anæsthesia and exaggeration of reflexes. The laminæ of the ninth, tenth and eleventh dorsal vertebræ and some extra-dural granulation tissue and pus were removed. Improvement began in twenty-four hours. In his first case (32), which was of one year's duration, the compression was due to an angular deformity, and after the removal of the fourth, fifth and sixth dorsal laminæ, it was completely relieved. Page reports that this case relapsed, but a personal communication from Mr. Lane a few weeks ago says that it is still cured. Thompson's case (43) was also one of angular compression of seven year's standing and had complete motor paralysis below the third rib, diminished sensibility and exaggeration of the deep and abolition of the superficial reflexes, but no bladder or rectal symptoms. The seventh cervical and first and second dorsal laminæ were removed. This patient entered the hospital with pneumonia nine months later and died, and an autopsy revealed the fact that there had been a small abscess present.

In Kraske's second case (46) in which there was a cure followed by a relapse and death two months later, due to tuberculosis, the pachymeningitis that had been the cause of the primary trouble was found to have been entirely overcome, but a new focus had been established lower down. Kraske's fourth case (48), with complete motor and sensory paralysis, vesical paresis and a curvature at the level of the eighth and ninth dorsal vertebræ, showed a slight improvement after the resection of these vertebræ, that is, his bladder symptoms disappeared and he could raise his limbs from the bed, but in one month he had a relapse, which was relieved by a plaster jacket, but five months later all improvement had ceased.

In Chipault's first case (49) the disease had lasted fourteen months and there was complete paraplegia with a curvature whose apex was at the seventh dorsal vertebra, the superficial and deep reflexes were exaggerated and there was no vesico-rectal difficulty and no anæsthesia. The laminæ of the fifth, sixth, seventh, and eighth dorsal vertebræ were removed and the next day the patient was able to move the toes of both sides. Finally he lost all he had gained on the right side.

In his fourth case (52) between the fourth and fifth pair of nerves there was a considerable number of fungous granulations and a dozen sequestra of the size of a cherry pit. These came from the body of the fourth dorsal vertebra. This patient had only been ill four months. In his fifth patient (53) there was discovered on raising the cord so as to inspect its anterior surface a fungous growth, which upon removal allowed of the escape of considerable pus and exposed two fistulæ, one leading into the body of the first and the other into the bodies of the second and third dorsal vertebræ.

My own case (74) revealed a cause of compression that was entirely different from any of the others in the table. This patient had a very acute curve due to disease of the bodies of the vertebræ. The removal was begun at the apex of the curve and when the laminæ of the tenth dorsal vertebra had been removed it was discovered that the cord was compressed by a thick, firm band, both above and below. In order to examine these bands carefully the ninth and eleventh laminæ were also removed when the same condition was discovered. These bands were found on dissection to be the thickened interspinous ligaments which, in consequence of the separation of the posterior part of the spinal column by the curve, had slipped down until they caused firm compression of the cord. The laminæ of the eighth and twelfth vertebræ were then resected and these bands dissected away from the dura to which they were closely adherent. Pulsation then gradually returned and it was also possible to explore the spinal canal above and below with a probe without the slightest difficulty.

Lastly, Page's case (54) had been suffering from the disease for five years and he had incomplete motor paraplegia, limbs wasted and spastic. Sensation was diminished as high as the lumbar back and lower abdomen; there was occasional incontinence of urine and a curvature extending from the fifth to the tenth dorsal vertebræ. He had some symptoms pointing towards secondary degeneration. Upon resection of the laminæ of the seventh and eighth dorsal vertebræ firm ankylosis between all the bony parts was observed; the dura was not adherent and the probe passed along a bony sinus to the front of the spinal canal and into the bodies of the vertebræ, giving exit to a pus-like caseous material. The body was not scraped out. The day after and for several days his urine had to be drawn and finally it was passed involuntarily; there was also a slight cystitis. Although Page reports that this patient was not improved by the operation he could finally walk.

One argument that has been urged against the application of this method of treatment is that the removal of the arches in cases where the bodies of the vertebræ are diseased, must still further weaken an already weak spine. This is undoubtedly true, but in any case where at the time of the operation it is found that the spinal column seems to be dangerously weak, Hadra's method of wiring the vertebræ could be employed. If there is no immediate danger from the effects of the removal of this portion of the spine the natural tendency will be for the operative gap to fill up either with a dense, fibrous tissue, as has been demonstrated in some of the cases where a secondary operation has become necessary, or there may be a deposit of new bone, as in Chipault's case (53) where a thin shell, proven by histological examination to be osteo-plastic, was found.

If Abbe's technique is employed the section of the arches is made subperiostially and the spines are left attached to one of the flaps so that the probabilities are in favor of the formation of new bone. Urban has suggested what he calls a temporary resection where one side of the arch is severed completely, while the other side is only cut through sufficiently to allow of its being bent back, exposing the cord. This method has been applied four times, twice for fracture with success and twice unsuccessfully (72 and 73) for Pott's disease.

I believe that extension and counter-extension should be continued for a considerable period after the operation in the hope that if ankylosis has not already taken place in the bodies the kyphosis may be somewhat reduced while the rest for the spine will favor more rapid union of the diseased bones.

Page's case and one of Schede's (59) illustrate a point which was observed in the traumatic cases, that an operative manipulation of the cord may cause an increase of the symptoms for a short time after the operation, thus increasing the probabilities of an increase in the inflammatory conditions if the operation is undertaken after they are established. In both these cases the mallet and the chisel were employed instead of the cutting forceps which seem to me to be preferable. In the traumatic lesions we can wait for this to subside, but in the compression cases of long standing the risk must be assumed.

It is undoubtedly very hard to deduce absolute conclusions from such a small number of cases as those which we have been able to tabulate, yet it is extremely important to determine what is to be expected from the operation. Personally, I cannot say that I can see any very brilliant future for it. It can be applicable to less than fifty per cent. of the cases of Pott's disease, as proven by the statistics of Gibney and Myers, and even in this small number its application is limited again to those cases where the compression has not produced a complete degeneration of the cord. Still, it is not by any means to be relegated to the obsolete class of operations; it has a place and that place, I am convinced, is destined to play a more important part in the therapeutics of Pott's disease than it has done heretofore, as its limitations are more fully understood and its technique simplified. Several of the cases that have been operated upon I believe might have been benefited, in all probability, by the proper application of mechanical means, and even some, where mechanical measures were employed, were operated upon too soon to determine the probable results. It is possible, however, to formulate certain principles which should serve as a guide until a larger number of cases enables us to determine upon fixed rules.

The operation is naturally contra-indicated.

1. In cases where there are other complicating tubercular ions.

2. In cases where mechanical treatment has not been applied.

It is indicated:

1. In cases where posterior spinal disease is made out as the cause of the paraplegia.

2. In cases where the lesion seems to indicate the failure of mechanical treatment, *i. e.*, where dislocation has occurred or where a sequestrum is causing the compression.

3. In cases where during the employment of intelligently applied apparatus the symptoms continue to increase in severity.

4. In cases where after a certain period of careful mechanical treatment, say eighteen months, the condition has remained stationary.

5. In cases where pressure myelitis threatens the integrity of the cord.

In all cases where sinuses lead down to, or can be safely straightened so as to allow the probe to explore the abscess cavity with which they communicate, they should be enlarged so as to provide thorough drainage, and if sequestra are present they should be removed.

I should incise and treat all abscesses connecting with the spine, approaching near enough to the skin to allow of their being opened without a dangerous dissection; they should be then explored, washed out, and drained.

Although the statistics of the cervical cases are slightly less favorable than those of the other regions, the dangers to life even without operative interference are also greater. One of the cervical cases died from inhibition of the phrenic nerves. In this case the disease was localized at the third and fourth cervical vertebræ and in order to determine the presence or absence of an abscess or tumor in the cord, exploratory puncture was resorted to. The result emphasizes the dangers of interference with the cord where the lesion is at the level.

At the same time in disease in the cervical region there is constant danger that the pachymeningitis will extend upwards and by making pressure about this area of the origin of the phrenic nerves cause respiratory difficulties. In my opinion, therefore, whenever there are any indications that the inflammatory conditions are extending towards this portion of the cord, operation should be undertaken at once. The opening of the spine may be sufficient to avert the dangers due to phrenic disturbance and of course there is the strong possibility of the total arrest of the process. The urgency of the condition would render the operative treatment advisable even though the results were more unfavorable than they are.

In conclusion, I must thank Dr. Schede of Hamburg, Mr. Arbuthnot Lane, Mr. Davies-Colley and Dr. Bowlby, of London, Mr. Norman Porritt, of Huddersfield, England, and Drs. Phelps, Abbe, Gerster, and Wyeth, for placing their cases at my disposal. Several of the cases have never before been reported, and in many of those that have been published I have been able to obtain later data.

The case reported by Chipault as having been operated upon by Chairman, proves upon investigation to be one of the eight included in Dr. Robt. Abbe's paper on Spinal Surgery, to which he referred when this subject was being discussed in the Surgical Section of the Academy of Medicine of which he was chairman.

TABLE OF CASES.

Operator.	Region.	Duration of Disease.	Age and Sex.	Symptoms.	Operation.
1. Heine.					
2. Holscher.					
3. Duypuytren.					
4. Jackson. 1882.	Dorsal.	Six months.	Twelve years. Male.	Third month paralysis and wasting of lower limbs; deep reflexes exaggerated; straining in micturition; no sensory troubles. Sixth month angular curvature tonic, spasm of limbs; anæsthesia; incontinence of urine.	Resection of spine and lamina of ninth dorsal vert. dura exposed but not opened; "spinal cord rose to the opening made in the bone."
5. Israel. 1882.	Dorso-lumbar.		Thirty-four years.	Paraplegia with complete loss of reflexes; no anæsthesia nor paralysis of sphincters; fever.	Opening posteriorly made into spinal canal and part of twelfth dorsal body and intervertebral cartilage between it and first lumb. removed; pus evacuated and a sequestrum removed.
6 Macewen. 1883.	Dorsal.	Three years in plaster jacket.	Nine years. Male.	Complete motor and sensory paraplegia; incontinence of urine and fæces; (eighteen to twenty-four months) ankylosis, limbs wasted and spastic.	Resection laminæ fifth, sixth and seventh, dorsal vertebræ; no pulsation in cord; thick connective tissue dissected off back of dura when cord began to pulsate.
7. Macewen. 1884.			Female.		Removal of dense connective tissue between the theca and the bone and part of adherent theca; cord shrunken without pulsation; removal of laminæ until pulsating cord exposed.
8. Macewen.					
9. Macewen.				Pyrexia due to tuberculosis.	
10. Macewen.				Ibid.	
11. Southam. 1885.	Dorsal.	Few days.	Six years. Male.	Angular curvature; absolute motor and sensory paralysis; respiratory troubles; fever; apparently dying.	Removal of third dorsal laminæ giving exit to about fifteen minims of pus.

TABLE OF CASES.

Subsequent Course.	Result.	Remarks.	Reference.
			Ashurst, Injuries to the Spine.
			Ashurst, Injuries to the Spine.
			Ashurst, Injuries to the Spine.
Wound healed fifteen days; in week could micturate properly; painful tonic contractions had disappeared; could draw knees up to abdomen, move toes and feel throughout limbs.	Partial (?) recovery.		Aiken, Brit. Med. Journ., 1883, Vol. I., p. 812.
Fever ceased; no improvement in paraplegia.	Death thirty-seven days.	Empyema caused by infection from a perforation in pleura during resection of twelfth rib in tracing up the abscess to the bony focus.	Berliner Klin. Wochenshrift, March 6, 1882.
Twenty-four hours, limbs warmer and less rigid returning sensation; eight days movements in limbs and control over sphincters; six months could walk without support; five years could walk five miles, play football, etc.	Recovery.	Between the theca and the bone a fibrous neoplasm one-eighth inch in thickness, and firmly attached to it and covering about two-thirds of its circumference was found.	Brit. Med. Journ., 1888, Vol. II., p. 308, Case I. Ibid, 1886, Vol. I., p. 40.
Ten hours, limb warmer, less livid and with subjective sensations; fourth day, continence urine and fæces; sensation returned quickly, motion slowly; eight months, could walk one-fourth mile; Four years, still well.	Recovery.		Ibid, Case II.
	Recovery.		Ibid, Case III.
	Death possibly hastened by operation, occurred in one week.		Ibid, Case IV.
	Unimproved; death some months later; general tuberculosis.		Ibid, Case V.
Temporary improvement in respiration; broncho-pneumonia.	Death in twenty-four hours.		Brit. Med. Journ., 1888, Vol. II., p. 665.

TABLE OF CASES.

Operator.	Region.	Duration of Disease.	Age and Sex.	Symptoms.	Operation.
12. Horsley. 1888.		Twenty months.	Sixty-two years. Male.	Complete paraplegia and pain.	
13. Horsley. 1889.		One year.	Fifteen years. Female.	Complete paraplegia and pulmonary tuberculosis.	
14. Horsley. 1889.		Five years.	Twenty three years. Female.	Paraplegia five years.	
15. Horsley. 1889.		Three years.	Sixteen years. Male.	Paraplegia and weakness of left arm.	
16. Horsley. 1889.		Eighteen months.	Sixteen years. Male.	Paraplegia.	
17. Horsley. 1889.		Eight months.	Seventeen years. Male.	Paraplegia.	
18. Horsley. 1888.	Cervical.	Eleven months.	Fifteen years. Male.	Complete paralysis of all four limbs; severe caries of the second and third cerv. vert.	Removal of second and third cervical arches.
19. Wright.	Dorsal.	Under treatment six months.	Seven years. Male.	Ill seven months; angular curvature in mid-dorsal region; paresis, etc.; later spastic paralysis of lower limbs; anæsthesia as high as eleventh rib; incontinence of urine and fæces; no abscess.	Resection three prominent arches; lower part of exposed theca covered with leathery substance, which was cut away; no pulsation of cord; no constriction found.
20. Duncan, 1888.	Dorsal.	Twenty-one months.	Four years. Boy.	Angular curvature in mid-dorsal region; spastic paralysis almost absolute as high as groin; anæsthesia as high as abdomen; bladder and rectum not affected.	Resection, of fourth, fifth, sixth and seventh dorsal arches; membranes adherent to bone by granulation tissue which was scraped away; dura white and smooth; faint pulsation then observed; plaster jacket.
21 Abbe. 1888.	Dorsal.	Five months.	Two years. Male.	Pain and swelling over tenth dorsal vertebra; temp. hectic; swelling contains pus; partial loss of motor and sensory power in lower limbs; partial paralysis rectum and bladder; deep reflexes exaggerated.	Evacuation of pus; removal eighth, ninth and tenth dorsal arches which were carious. Dense mass connective tissue and detritus scraped away from posterior part of dura.

TABLE OF CASES.

Subsequent Course.	Result.	Remarks.	Reference.
	Death in six weeks, exhaustion.	Large abscess in front of vertebral bodies.	British Medical Journal 1890, Vol. II, Page 1289.
Bony abscess; return of sensation in ten days; could walk in July, 1889.	Recovery.		Ibid.
Improvement of motion and sensation.	Improved.		Ibid.
In statu quo.	No improvement.		Ibid.
Improvement, motion and sensation.	Improved.	Abscess in bone.	Ibid.
Very slow improvement in motion.	Improved.		Ibid.
Wound healed; movement of legs on eighth day; of arms later; rapidly regaining power.	Recovery.		Med. Chir. Trans., Vol. LXXI., 1888, p. 402.
Twelfth day returning sensation, spreading down limbs; twenty-seventh day sensation to left foot and right knee; fifteenth day flexion of thighs possible; fifty-first day relapse and in few days as bad as ever.	No improvement.	After six months no change, theca surrounded by a buff-colored, tough leathery substance.	Lancet, July 14, 1888, p. 64–66.
Third day move ankles and recognize a touch; seventh day moved knee; fourteenth day move both limbs; anæsthesia overcome; three and half months walked little with spastic gait; sensation good.	Recovery.		Edin. Med. Journ., March, 1889, p. 829.
One week sensation began to return; four months general health good, could walk with chair; improving.	Recovery.	Still well February 1, 1891.	N. Y. Med. Journ., Nov. 24, 1888. Thorburn, l. c., p. 166. Personal communication, February 1, 1891.

TABLE OF CASES.

Operator.	Region.	Duration of Disease.	Age and Sex.	Symptoms.	Operation.
22. Abbe. 1889.	Dorsal.	Four months.		Two years previous pleurisy and then fistula in ano; slight phthisical changes apex left lung; lumbar abscess over iliac crest; five months later probe passed up to twelfth dorsal.	Removal transverse process twelfth dorsal which was carious, and one-half of the vertebral body was scraped out without injury to dura.
23. Deaver. 1888.	Cervical.	Four months.	Forty-five years. Female.	Paralysis of left leg, followed by arm; exaggerated deep reflexes on both sides; no anæsthesia; deep, painful swelling on left side of neck.	Removal of carious third and fourth cerv. arches; dura adherent to bone and thickened; exploring needle introduced into it with no result.
24. White. 1888.	Dorsal.	Nine months.	Adult. Twenty three years.		
25. Dercum and White. 1888.	Dorsal.	Ten months.	Fifty-five years. Male.	Complete paraplegia and anæsthesia below nipples; girdle pains; bed sore; reflexes exaggerated; pain over third and fourth dorsal vert.	Removal first, second, third, fourth and fifth dorsal lam.; dura opened and adhesions between cord and dura broken up.
26. Demons. 1888.	Dorsal.		Thirty-five years.	Complete paraplegia; paralysis rectum and bladder; pain.	Removal third, fourth and fifth dorsal vertebræ.
27. Wright. 1889.	Dorsal.		Ten years.	Same case as No. 18.	Removal some more arches; bony fragments implanted.
28. Bullard and Burrell. 1889.	Dorsal.	Seven and one-half months.	Forty-six years. Male.	Intense pain; bedsore exposing sacrum and extending onto either buttock; sloughs at various other points; cystitis; complete paraplegia; knee jerks increased; sensation diminished in front below seventh intercostal spaces; behind decided diminution to level of lower dorsal and slight to level of sixth; curvature fourth, fifth and sixth dorsal.	Removal spines and laminæ third, fourth, fifth and sixth dorsal; cord flattened and no pulsation opposite fifth vertebra; laminæ returned to place.

TABLE OF CASES.

Subsequent Course.	Result.	Remarks.	Reference.
Left hospital in six weeks with but one sinus.	Cure.	Still well Feb. 1, 1891.	Abbe, N. Y. Med. Record, July 26, 1890, p. 85. Personal communication, Feb. 1, 1891.
Respiration embarrassed towards end of operation and continued; patient died three days.	Death three days.	Death attributed to injury to region of phrenic nerves by needle. P. M.—Compression, hemorrhage and degeneration of left side of cord due to inflammatory growth.	Amer. Jour. Med. Sc., Dec., 1888, Thorburn, Spinal Surgery, p. 166.
	Death.	Tuberculosis, ether and amyloid kidneys.	Annals of Surgery, June, 1889.
Immediate relief of pain, amelioration in symptoms began next day.	Cure.		Ibid, July, 1890, p. 37.
Improved for several days; no improvement in motion.	Death.	Compression of cord not discovered at operation.	Princeteau: Bull. Soc. Anat and Phys., Bordeaux, Vol. LIX., 1888, p. 288.
Nervous symptoms practically unaltered; general health better.	Unrelieved.		Thorburn, l. c. p. 166.
Patient very cyanotic; breathing with difficulty.	Death from shock in thirty-six hours.		Transactions Amer. Ortho. Asso., Vol. II., p. 244.

TABLE OF CASES.

Operator.	Region.	Duration of Disease.	Age and Sex.	Symptoms.	Operation.
29. Wyeth, 1889.	Dorsal.	Two and one-half years	Nine years. Male.	Curvature at fourth, fifth and sixth dorsal spines; complete paraplegia; vesical paralysis; voluntary defecation; sensation normal; urethritis and cystitis caused by catheterization supra pubic cystotomy.	Removal fourth, fifth and sixth dorsal laminæ; dura tense beneath right lamina of fifth; intradural tumor, one-half inch perpendicular measurement; contained pus which was evacuated.
30. Gerster, 1888.	Dorsal.	Long standing.	Fourteen years. Male.	Complete paraglegia; pain; difficulty in controlling rectum and bladder.	Removal laminæ sixth and seventh dorsal vert.; extensive extra- and sub-dural abscess evacuated; extensive caseation of soft tissues adjoining inter-vertebral focus in which imbedded roots of motor and sensory nerves on both sides; transverse process of fifth, sixth, seventh and eighth thoracic vert. on right and fifth, sixth and seventh on left carious and costo-vertebral joints destroyed; these and heads of corresponding ribs removed; bodies sixth and seventh vert. much disintegrated and were gouged out.
31. Bates. 1889.	Cervical.				Removal laminæ; fifth cervical.
32. Arbuthnot Lane. 1889.	Dorsal.	One year.	Male. Seven and one-half years.	Paralyzed eleven months; curvature about fifth dorsal vertebra.	Removal spinous processes and laminæ fourth, fifth and sixth dorsal vert.; body of fifth appeared abnormally near laminæ of adjoining vertebræ and cord seemed forcibly compressed between these bony points.
33. Arbuthnot Lane. 1890.	Dorsal.	Two years.	Male. Thirty-two years.	Analgesia both sides; anæsthesia almost complete; reflexes exaggerated.	Removal spinous processes ninth, tenth and eleventh dorsal vertebræ and extra-dural granulation tissue and pus.

TABLE OF CASES.

Subsequent Course.	Result.	Remarks.	Reference.
March, patient walking about; Jan. 24, 1891, is reported to be perfectly cured; Sep. 3, 1891, "able to go through all the ordinary movements of the lower extremities."	Recovery.		Inter. Journ. Surg., 1890, April. Personal communication, January 24, 1891. N. Y. Med. Jour. Sept. 3, 1891.
No immediate improvement in paralysis; three months later however rapid improvement; able to support himself without aid; seventh month discharged from hospital; still small sinus.	Improved.		Personal communication.
	Death in four days.	Nothing found at operation but at autopsy caries of fourth and fifth vertebræ.	Richardson; Brooklyn Med. Journ., 1889, Vol. III., p. 401.
Month after operation could move both legs freely.	Cure.		Brit. Med. Journ., April 20, 1889.
Improvement began in twenty-four hours.	Cure.		Lancet, July 5, 1890, p. 11.

TABLE OF CASES.

Operator.	Region.	Disease. of Duration	Age and Sex.	Symptoms.	Operation.
34. Arbuthnot Lane. 1890.	Dorsal.	Three years.	Male. Sixteen years.	Abdomen distended and muscles paralyzed and reflexes absent; knee and ankle clonus very marked; no plantar reflex; sensation as high as sixth rib impaired, but only absent around left knee; spinous process fifth dorsal formed apex of abrupt angular curve; occasional trouble sphincters.	Removal spinous processes and laminæ fourth, fifth and sixth dorsal vertebræ; cord splayed over wall tense abscess cavity which appeared on cut surface; curdy material evacuated through incision; cavities in and about bodies of dorsal vert. as large as tangerine orange containing caseous matter and comparatively large fragments necrosed bone which were removed; cavity filled with iodoform emulsion; drainage tube.
35. Arbuthnot Lane.	Dorsal.	Four years.	Female. Twenty one years.	Four years ago enlarged gland appeared in neck; about same time fell down stairs, hurting back; two months later pain in back and inability to sit up; rest in bed few weeks overcame disability and pain; two and one-half years ago prominence in back; right knee joint swollen and painful; lost power right leg and then motion impaired; later same result established in left leg; seven weeks recumbent position no benefit; pulpy change right knee and slight backwards dislocation; prominence just below centre dorsal spine; tenth dorsal and subjacent vert. region in plane in front of ninth dorsal; feet blue and cold; no motion of legs and no sensation; plantar reflex; ankle clonus and depressed patellar reflex left side; none on right; no hyperæsthesia; abdominal reflexes fairly well marked.	Removal spinous processes and laminæ ninth tenth and eleventh dorsal vertebræ; cord forcibly compressed between body of tenth and laminæ of eleventh; an abrupt and considerable change in its antero-posterior diameter being observed in consequence; drainage for forty-eight hours.

TABLE OF CASES.

Subsequent Course.	Result.	Remarks.	Reference.
Wound healed eighth day; sensation and motion returned rapidly; marked improvement in forty-eight hours; improved steadily up to certain point, could move leg easily, then began to diminish and finally motion almost disappeared though sensation remained but little impaired.	Improved then relapsed; not benefited; June 6, 1891 only slightly benefited; died of influenza and pneumonia.	A second operation showed cord surrounded by abundant caseous material which extended into muscles and neighboring parts for considerable distance; as much as possible removed without much benefit; operated upon a third time and benefited slightly; destruction of bodies then most extensive.	Brit. Med., Journ., 1891, Vol. I. p. 1227. Personal communication, March, 1892.
Day following no perceptible improvement though patient insisted limbs felt different than before operation; one week could distinguish between hot and cold, but could not localize place touched; painful spasm in legs and pulpy knee gave pain when flexed; fifteen days moves muscles left leg; sensation improved in both; twenty-five days sensation normal both legs, motion improved.	Improved after first operation then relapsed and after second operation, "recovered complete voluntary control over legs;" cure; died in 1891 of pulmonary phthisis; no return of paraplegia.	Twenty-five days after first operation, pulpy right knee excised with excellent result; five months later paraplegia returned rapidly with cystitis; cord exposed at once and found splayed out over abscess from which much pus, curdy material and carious bone was evacuated and which involved bodies of three vertebræ; daily injections iodoform and glycerine emulsion through metal drainage tube, which was removed after several weeks.	Brit. Med. Journ., 1891, Vol. I., p. 1227. Personal communication, March, 1892.

TABLE OF CASES.

Operator.	Region.	Duration of Disease.	Age and Sex.	Symptoms.	Operation.
36. Arbuthnot Lane, 1890.	Dorsal.	One year.	Female. Four and one-half years.	Paraplegia appeared a month before admission to hospital and became almost complete in four days; fifth dorsal vertebra summit of kyphos; four months later incontinence of urine in spite of continued enforced dorsal decubitus; sensation only slightly impaired; operation, December 31, 1890.	Removal fourth, fifth and sixth dorsal laminæ; cord compressed by wall of large abscess which seemed to involve the bodies of the vertebræ and to extend into the thorax; it was thoroughly cleaned, filled with iodoform and glycerine and a channel cut between the transverse processes for a drainage tube.
37. Arbuthnot Lane. 1891.	Dorsal.	Five years.	Male. Twenty three years.	Had mid-dorsal deformity for a few months and then paraplegia five years ago; recovered power in legs after recumbency for fifteen months, but since suffered from deep seated pains in thorax; partial paraplegia returned three months before admission and progressed; was a most feeble, phthisical looking creature; operation, July, 1891.	Cord compressed by wall of abscess which was very extensive and extended into the chest where a cavity was found nearly as large as an orange, the walls of which were in great part bony, showing that the first paraplegia was relieved by the abscess extending into the thorax where it became encapsulated.
38. Arbuthnot Lane. 1891.	Dorsal.	Three months' deformity.	Male. Seven years.	Six weeks prior to admission to hospital paraplegia set in and rapidly became pretty complete; sensation much impaired; partial incontinence; operation, February, 1891.	Sixth dorsal vertebra was centre of curve; laminæ removed and large abscess compressing cord and extending into the bodies of several vertebræ found.
39. Arbuthnot Lane. 1891.	Dorsal.	Two years.	Female. Five and one-half years.	Incomplete paraplegia; very feeble, delicate child; mid-dorsal curve.	Cord found compressed by a very large abscess which entered freely into the thorax; much necrosed bone removed; destruction of vertebræ being very great.
40. Arbuthnot Lane. 1891.	Dorsal.	Three years.	Male. Eight years.	Had deformity about three years and paraplegia three weeks which was almost complete at time of operation; extensive dorsal curve, miserably delicate child.	Large abscess compressing cord and extending into thoracic cavity for considerable distance; cleaned and filled with iodoform-glycerine; operation of great difficulty owing to very limited respiratory capacity.

TABLE OF CASES.

Subsequent Course.	Result.	Remarks.	Reference.
Progress very satisfactory for five days.	Death from hemorrhage from rectal polypus; while spinal condition progressing satisfactorily.	Purge given five days after the operation; next morning a hemorrhage into the bowel from a rectal polypus, caused death in spite of all precautions.	Personal communication.
He can use his legs with perfect freedom, but his health is very delicate.	Cure.	"As far as his paraplegia is concerned, he is practically well."	Personal communication.
Recovered rapidly and completely.	Cure.	"Has had no recurrence of the paraplegia and the spinal caries is also apparently quite cured."	Personal communication.
	Death in a few hours.		Personal communication.
"Recovered power in his legs rapidly and completely."	Cure.	"Saw him to-day (March 14, 1892) and found that a small sinus had formed over the curvature, but he could walk as well as ever."	Personal communication.

TABLE OF CASES.

Operator.	Region.	Duration of Disease.	Age and Sex.	Symptoms.	Operation.
41. Arbuthnot Lane. 1891.	Dorsal.	Two years.	Male. Seven-years.	History of disease for two years and of paraplegia for five weeks, the latter coming on very rapidly; incontinence; fifth dorsal vertebra forms summit of the curve.	Large abscess compressing cord.
42. Arbuthnot Lane. 1891.	Dorsal.	One year.	Male. Seven years.	Paraplegia for one month; sensation much impaired.	Extensive amount caseous or curdy material compressing front of cord and involving the bodies of third and fourth vertebræ, and only apparently affecting their posterior surfaces.
43. Thompson. 1889.	Dorsal.	Six years.	Fifteen years. Male.	Complete motor paralysis below third rib; sensibility retarded; deep reflexes exaggerated superficial reflexes abolished; no bladder or rectal symptoms.	Removal laminæ first, second and third dorsal; pressure on cord from curve.
44. Colman.	Dorsal.	Eighteen months.	Sixty-four years. Male.	Complete paraplegia and anæsthesia to level of umbilicus; no control over sphincters; reflexes exaggerated; knee jerks exaggerated; no ankle clonus.	
45. Kraske.	Dorsal.		Thirty-three years.		Removal of three dorsal arches.
46. Kraske.	Dorsal.		Fifty-seven years. Female.	Caries of the fifth dorsal vertebra; paraplegia.	Removal of the fourth, fifth and sixth arches; caries of the fifth.
47. Kraske.	Dorsal.		Fourteen years. Male.	Complete paraplegia; vesical paresis; marked curvature at fifth and sixth dorsal vert.	Removal lam. and sixth dorsal vert.

TABLE OF CASES.

Subsequent Course.	Result.	Remarks.	Reference.
"Recovered power completely."	Cure.	"Saw him a fortnight ago; found no recurrence of spinal caries which was apparently well."	Personal communication.
Improved for a time and relapsed.	No improvement after two operations.	Second operation followed by no good result, sent out without having derived any benefit; recurrence of tubercular material very rapid and extensive.	Personal communication.
Six months recovered so completely that he could run and jump and even stand on head.	Cure.	Died of pneumonia nine months later. P. M.—Small abscess cavity containing pus.	London Lancet, 1889, Vol. II., pp. 315-316.
Nine days after the operation sensibility began to return, no improvement in motion.	Death two months, exhaustion.	Cord compressed by mass granulation tissue; bodies eighth and ninth dorsal vert. completely excavated; large chronic abscess anteriorly; intense myelitis at point of compression and disorganization not complete as on long. section axis cylinders traced; well marked descending degeneration in part of median and adjacent part of post-external column in direct cerebellar tract and in the ascending lateral tract of Gowers; well marked neuritis of roots at point of compression extending down into nerve trunk.	Lancet, February 22, 1890, Vol. I., p. 402.
No improvement.	Death in eight weeks.	Extensive ulceration of back. P. M.—Very extensive pachymeningitis; all compression not removed although three arches resected.	Centralblatt f. Chir., 25, 1890.
Afternoon sensation in legs; four days patient could move left, and a few days later right leg; four weeks tried to walk.	Cure, then recurrence after two months.	Death seven months later; tuberculosis; recurrence due to compression below sixth vert.; pachymeningitis at former level completely cured.	Ibid.
Some hours after could move limbs; two months later relapse to complete paraplegia.	No improvement.		bid.

TABLE OF CASES.

Operator.	Region.	Duration of Disease.	Age and Sex.	Symptoms.	Operation.
48. Kraske.	Dorsal.		Thirteen years. Male.	Complete motor and sensory paraplegia; vesical paresis; curve at level of eighth and ninth dorsal.	Removal eighth, ninth and one other arch.
Chipault. 1890.	Dorsal.	Fourteen months.	Nine years. Male.	Complete paraplegia; curvature apex seventh dorsal; superficial and deep reflexes exaggerated; no vesico-rectal difficulty; no anæsthesia.	Removal fifth, sixth, seventh and eighth dorsal arches.
50. Chipault. 1890.	Dorsal.	More than one year.	Nine years. Male.	Complete paraplegia; curvature in sup. dorsal region including six vert.; no pain; faradic and galvanic reaction preserved; frequent micturition; no cystitis; reflexes exaggerated, especially on left side; sciatic pains on right side; recent cavity in right apex; congestion of left apex; bad general condition.	Removal fourth, fifth, sixth, seventh and eighth dorsal laminæ; fifth carious and membranes adherent.
51. Chipault.	Upper dorsal.	Six months.	Male. Nine years.	Complete paraplegia; incontinence of urine; third, fourth, fifth, sixth and seventh dorsal vertebræ, acute angled curve, inclining to the left; compensatory lumbar scoliosis; atrophy lower extremities; slightest touch causes limbs to be violently flexed; patellar reflex exaggerated; cremasteric reflex lost; anæsthesia complete up to umbilicus: no hyperæsthesia; no cystitis; no incontinence of fæces; symptoms increasing under mechanical treatment.	Removal five arches, (second, third, fourth, fifth and sixth dorsal) after reflecting the periosteum; the meningeal coverings normal except at space of about seven centimetres where it is pressed backwards, deprived of its fatty envelope, flattened, congested and bent; at this point a bony projection could be made out; the cord was separated and raised at the level of the third dorsal vertebra, where pus escaped; the bony projection was cut away; enormous destruction vertebral bodies; complete section of the cord at this level.

TABLE OF CASES.

Subsequent Course.	Result.	Remarks.	Reference.
Eight days began to move limbs.	Slight improvement.	Soon could raise limbs from bed, bladder normal, one month later relapse, improved in plaster jacket; five months later can move limbs but not improving.	Centralblatt f. Chir., 25, 1890.
Next day could move toes of both sides; finally lost all he gained in right side; still motion in left.	Improved.		Révue de Chirurgie, Oct., Nov. and Dec., 1890.
Same evening could flex toes of both feet; six days recovered all movements of lower extremities; sciatic pain disappeared at time of operation.	Death three weeks.	Broncho-pneumonia; cicatrical mass adherent to membranes over removed portion and inferior portion; third transverse process and left pedicle of fourth dorsal were carious and continuous with tubercular process of the bodies of the fifth, sixth and seventh, which were completely destroyed; fourth, eighth and ninth also destroyed in part; separated portions united by caseous mass containing two sequestra.	Ibid.
No improvement.	Death from pneumonia five or six weeks after the operation.	Autopsy: The site of operation covered in by thin shell proven by histological examination to be osteo periosteal; cord completely severed at point where bony projection was removed; complete destruction of the first, second, third fourth and fifth dorsal and the cavity was of the size of two fists.	Révue de Chirurgie, November, 1890

TABLE OF CASES.

Operator.	Region.	Duration of Disease.	Age and Sex.	Symptoms.	Operation.
52. Chipault.	Upper dorsal.	Four	Female [illegible] and one-half years.	Slight paraplegia; pain on pressure over fourth and fifth dorsal spines and two or three adjacent processes; extension of thigh only retained; electrical reaction practically normal; no anæsthesia; no trouble with sphincters; ankle clonus marked, particularly the right; exaggeration patellar reflexes; cutaneous reflexes normal; no improvement under mechanical treatment.	Removal of the arches and articular processes up to the posterior part of the pedicles and the articular processes, and between the fourth and fifth pair of nerves a considerable number of fungous granulations and a dozen sequestra of the size of a cherry pit; all came from the post. part of fourth body; drain introduced into the vertebral cavity; lavage.
53. Chipault.	Upper dorsal.	Three or four months.	Male.	Angular deformity. including first, second and third dorsal vertebræ; second forms apex of the curve; incomplete paraplegia; can move toes and flex knees; ankle clonus marked on the right; patellar reflexes exaggerated; getting worse under mechanical treatment; anæsthesia right foot as high as malleoli and paresis of the right arm limited to the flexors, superficial and deep of the ring and little fingers.	Removal arches first, second, third and fourth dorsal, and after raising the cord a fungous growth observed between the second and third dorsal pair of nerves; upon its removal escape of considerable pus; two fistulæ lead into the body of first and bodies of the second and third vertebræ; these cleaned as thoroughly as possible; fungous granulations removed from membranes; they were especially abundant about the first pair which appeared red, congested, wrinkled, explaining the paralysis of this pair.
54. Page. 1889.	Dorsal.	Five years.	Twenty years. Male.	Incomplete motor paraplegia, limbs wasted and spastic, sensation diminished as high as "lumbar back and lower abdomen;" occasional incontinence of urine; curvature extending from fifth to tenth dorsal vertebræ; some symptoms of secondary degeneration apparently present; ankle clonus, no improvement under treatment.	Resection laminæ seventh and eighth dorsal vertebræ; firm ankylosis of all bony parts which were sclerosed; chisel and mallet used to complete opening in canal during which there were muscular twitchings of legs; dura not adherent; probe passed along bony sinus to front of spinal canal and into bodies of vertebræ, giving exit to pus-like caseous matter; this not removed.
55. Podres.	Cervical.			Paralysis.	Removal sixth and seventh cerv. bodies.

TABLE OF CASES.

Subsequent Course.	Result.	Remarks.	Reference.
Improving.	Improved.		Révue de Chirurgie, November, 1891.
Improvement remarkable and rapid; in six hours could raise both heels from the bed; the paralysis seemed to have entirely disappeared; reflexes normal next day; pains of arm gone on fourth day.	Cure.		Ibid.
Day after and for six days urine had to be drawn by catheter and then passed involuntarily and without sensation; slight cystitis two days after operation, tickling sensations in both legs and soles and twitching muscles of right leg; this disappeared about sixteenth day; knee jerks less exaggerated; ankle clonus less; no voluntary power; finally could walk.	Improved.		Lancet, December 6, 1890, Vol. II., p. 1210.
	Recovery.		Russkaja Med. No. 19, 1886, Ther. Gaz., October 15, 1891. White.

TABLE OF CASES.

Operator.	Region.	Duration of Disease.	Age and Sex.	Symptoms.	Operation.
56. Borchel.	Dorsal.				
57. Buffet.	Lumbar.				
58. Thorburn.	Dorsal.		Six years.	Pott's paralysis.	Removal laminæ of third dorsal vertebra, making opening of size of sixpence in spinal canal; escape of about fifteen minims pus; apparently healthy dura at bottom of wound; drainage tube inserted into spinal canal and wound sutured.
59. Schede.	Cervical.	Eleven months.	Female. Fifteen years.	Rapid increase in symptoms in spite of careful treatment until paralysis complete in all four extremities; sensation retained; reflexes decreased; incontinence of urine and fæces; bed sores on pressure points, elbows, heels, sacrum; intense pain, only controllable by large doses of morphine; cystitis; emaciation; no fever.	Removal fifth and sixth cervical arches with mallet and chisel and forceps: considerable venous bleeding controlled by tampon and ligature; on right side of cord in region of fifth vert. dura was covered with granulation tissue which was easily removed with sharp spoon; canal probed up and down; wound packed with iodoform gauze and five pounds extension applied to head.

TABLE OF CASES.

Subsequent Course.	Result.	Remarks.	Reference.
	Recovery.		Schmidt's Jahrbücher: Phila. Med. Times, Sept. 8, 1883, White.
	Recovery.		Gaz. des Hospitaux, December 2, 1886, White.
			Ibid.
Breathing distinctly improved after operation but no other change; following morning improvement maintained but considerable pus in urine; no pus in dressing; afternoon of same day breathing again became much worse; temperature rose to 104.6°.	Death from asphyxia.	No autopsy.	Brit. Med. Journ., 1888, Vol II., pp. 665-666.
Next day greater loss of reflexes but two days later all were about normal; slight motion in toes, better in extension than flexion and on right than on left side; no longer complaining of pain; one month later slight improvement in motion but general condition worse.	Death forty-seven days after operation.	Autopsy: The cervical spine was very prominent and the vertebral canal was narrowed by the bodies of the vertebræ; the canal was occupied by a caseous mass filled with sequestra, which were adherent to the dura; the inner surface of the dura at this point was smooth and free; the cord was shrunken and softened but the nerve fibres could be made out on cross section; the fourth vert. was reduced to a caseous mass and the third projected towards the spinal canal and was turned on its axis so that its anterior surface articulated with the fifth which was only one-third its normal size owing to osteomyelitis; sixth and seventh cerv. normal but first and second dorsal confluent caseous focus, prevertebral abscess with caseous pus.	Personal communication.

TABLE OF CASES.

Operator.	Region.	Duration of Disease.	Age and Sex.	Symptoms.	Operation.
60. Schede.	Dorsal.	Four months.	Male. Four years.	Badly nourished child, with eczema face and phlyctenular keratitis; careful treatment did not arrest dorsal spinal disease; finally great pain in legs and thighs; slight flexion of thigh is the only motion possible in the lower extremities; no hyperæsthesia; no anæsthesia; Trousseau's phenomena absent; patellar reflexes, left almost lost, right exaggerated; tendo Achillis reflex weak on both sides; no ankle clonus; cremasteric reflex weak; reflexes in forearm and triceps, weak on both sides; paralysis of bladder and rectum; very sharp prominence third and fourth dorsal vert.; skin ulcerated and inflamed over this region; lordosis of lower dorsal vertebræ; prominence of second and third lumbar vert; every prominence painful on pressure; no psoas abscess.	Removal arches third and fourth dorsal vertebræ; dura smooth; cord pushed forward; dura above covered with gray-white granulations and a pseudo-membrane so that after removing arches of second and first dorsal this membrane was removed with scissors; cavity filled with caseous material in body third dors.; scraped out and two pea sized sequestra removed; cavity packed iodoform gauze.
61. Schede.	Dorsal.	Six months.	Male. Eighteen years.	Complete paraplegia and anæsthesia up to umbilicus, priapism; incontinentia urinæ et alvi; a slight prominence from second to fifth dorsal vertebræ painful on pressure; fluctuation on left side of kyphos.	Slight amount of yellow pus escaped on incision through the soft parts at level of third vert.; whole left arch of third dorsal carious; free pieces of bone easily removed; arches second to fifth removed; entire spinal canal at this level filled with fungous, caseous mass adherent to dura; this originated at carious third arch; it was removed and dura opened in several places; profuse hemorrhage.

TABLE OF CASES.

Subsequent Course.	Result.	Remarks.	Reference.
During operation a great deal of blood lost from veins in periosteum. "On account of narcosis, (chloroform) patient became cyanosed and asphyxiated;" half an hour after operation collapse; pulseless; no response to stimulation.	Death three hours after operation.	Autopsy: Caseous osteomyelitis from first to fourth dorsal; involvement of sixth, seventh and eighth dorsal; prevertebral abscess in upper dorsal region to right and left of column; caseous lymphatic tuberculosis in anterior mediastinum and at hilus of right lung; interstitial pneumonia of upper and middle lobes of right lung; softening of upper part of dorsal spinal cord.	Personal communication.
Next day general condition good, no improvement in cord symptoms; second day complained of difficulty in chewing; fourth day Koch's lymph; no improvement in paralysis, anæsthesia, etc.; two months later pleurisy.	Death two months and a half after operation; no improvement in symptoms before death.	Autopsy: Fistulous opening at upper part third dorsal vert. communicating gangrenous sequestrum and cavity size of cherry pit; involving the left half of the fifth dorsal and the intervertebral cartilage; the fourth and fifth vertebrae were gangrenous and the cavity here opened into the left mediastinum; in this vicinity the dura was thickened and covered with gangrenous debris; membranous growth under the pia; cord between third and fifth dorsal nerves greatly softened and atrophied and degenerated; tubercular empyema and pneumonia.	Personal communication.

TABLE OF CASES.

Operator.	Region.	Duration. of Disease.	Age and Sex.	Symptoms.	Operation.
62. Schede.	Dorsal.	More than one year.	Male. Twelve years.	In spite of careful treatment for more than one year symptoms continually growing worse until he had complete paraplegia; patellar reflex present more marked left side than right; ankle clonus; complete anæsthesia as high as umbilicus and hyperæsthesia from this point up to mamillary line; incontinentia urinæ et alvi; heart, lungs, abdominal organs normal; kyphos including eighth, ninth and tenth dorsal vert.; no abscess; upper extremities normal.	Removal arches eighth and ninth dorsal, escape of pus from spinal canal; cavity in body of vertebræ filled with sequestra; evacuated with sharp spoon; gray, white, caseous exudation over anterior surface dura; this removed with scissors; the cord although surrounded by pus seemed of normal consistency; cavity drained and extension applied.
63. Schede.	Dorsal.	About five months.	Female. Five years.	Fistula leading to transverse process of fourth and fifth dorsal vertebræ; tonic-clonic convulsions lower extremities and abdominal muscles; complete motor paralysis lower extremities; sensation normal; tendon reflexes neutralized; plantar reflexes weak; pain in abdomen; abdominal breathing; electrical reaction of nerves and muscles lost; incontinentia alvi et urinæ; abdomen distended and painful; meteorism.	Removal arches third, fourth, fifth, sixth and seventh dorsal vertebræ; well marked tubercular granulation mass with exudation lying on dura; removed with sharp spoon; small amount of pus; no necrosed bone; arch of sixth vert. carious.
64. Schede. 1891.	Dorsal.	Almost three years.	Male. Six years.	Lower limbs in state of rigid contraction; short clonic spasms at intervals; patellar reflexes present; slightest movement, even passive, causes intensely painful tonic contraction; sensation uncertain; no control over bladder or rectum; lordosis cervical region, sharp kyphosis including first, second, third and fourth dorsal vertebræ, and lordosis from this point to seventh dorsal.	Removal arches second, third and fourth dorsal and spinous process first; thick, gray, red pseudo-membrane lying between the bone and dura; medulla pressed backward towards arch; no pulsation; left side under cord granular debris removed with sharp spoon; irrigation 1-1000 bichloride sol.; drainage.

TABLE OF CASES.

Subsequent Course.	Result.	Remarks.	Reference.
Sensation slightly decreased next day; second day reflexes exaggerated; improvement very slight and only temporary; general condition constantly grew less favorable.	Death two months after operation.	Autopsy: Tubercular osteomyelitis first to seventh dorsal vert. eighth and ninth absent; caseous abscess; tubercular pleuritis, peri-pachymeningitis; tubercular infiltration spinal pia mater.	Personal communication.
Next day general condition slightly improved; no improvement in paralysis. P. M.—Collapse.	Death in collapse twenty-four hours after operation.	Autopsy: Purulent peritonitis; diphtheritic cystitis; pyelo-nephritis; phthisis pulmonalis, et gland, bronchial. fibrous red gray masses attached to dura in dorsal spinal canal, inner surface of dura smooth and free, cord itself normal except at lower half of operated portion where Goll's columns seem to be compressed; vert. bodies intact.	Personal communication.
Slight collapse following the operation; evening rigidity of muscles less; extension knee without great pain; next day conscious of passage of urine, but not of fæces, bed sore healing; one month later no improvement but protuberant granulation mass at site of operation; this was cleared away, more sequestræ found in old cavity and evacuated and while this was being done a fresh prevertebral abscess opened; washed out bichloride solution and packed iodoform gauze, all symptoms slightly improved.	Death three months after operation.	Autopsy: Multiple tubercular osteo-myelitis dorsalis; bodies two, three, four, five diseased; caseous foci in all the other dorsal bodies; myelomalacia dorsalis with ascending degeneration of posterior section and margins of pyramids.	Personal communication.

TABLE OF CASES.

Operator.	Region.	Duration of Disease.	Age and Sex.	Symptoms.	Operation.
65. Schede.	Dorsal.	Unknown.	Eleven years.	Complete paraplegia and anæsthesia up to nipples; no improvement under treatment covering two years; general nutrition bad; kyphos first, second and third dorsal vertebræ.	Removal arches last cervical and first dorsal vert.; caseous pus escaped from canal; cord appears atrophied; no sequestra found.
66. Schede. 1892.	Dorsal.	Four months.	Female. Fifteen years.	Pain in back four months; could not walk eight weeks; no gibbus; second to fifth dorsal vert. very sensitive; fluctuating abscess both sides these vertebræ; complete paraplegia; reflexes increased; at times tonic convulsions; foot clonus; sensibility retained; bladder and rectum normal; atrophy lower extremities marked; considerable diminution of constant and faradic excitability, especially in muscles; less in nerves; no bed sores.	Caseous abscess cut open on both sides above dorsal fascia extending from the second to the eighth dorsal vertebræ; no caries of the vertebral arches; transverse processes also intact; removal third to seventh arches; dura thickened and transformed at points into fungous tissue, covered and traversed by caseous material; this was removed; pia exposed from third to seventh vert.; no cord lesion observable; extension and counter extension. Collapse.
67. Phelps.		Three years.	Female. Four years.	Complete paraplegia.	
68. Davies-Colley.	Fourth, fifth and sixth dorsal vertebræ.	One year.	Seven years. Male.	Partial paraplegia; patellar reflex gone.	Removal laminæ of three vertebræ and much caseous material from bodies without relief of the paraplegia; six weeks later laminæ of two vert. below removed and abscess found on the anterior surface of the cord; cavity washed with iodoform emulsion; drainage tube continued to discharge for some weeks.
69. Davies-Colley.	Above middle of dorsal.	Three and one-half years.	Seven years. Male.	Partial paraplegia; loss of control of urine.	Laminæ and spines of third vert. removed; large, curdy collections in part scooped out.

TABLE OF CASES.

Subsequent Course.	Result.	Remarks.	Reference.
No improvement.	Death ten days after operation.	Autopsy: Spondylitis second, third, fourth, fifth, sixth and seventh dorsal; pleural adhesions both sides, well marked growth at site of operation; myelitis, atrophy of cord in diseased region, many bed-sores.	Personal communication.
No improvement.	No improvement; fourteen days after operation; still under observation.		Personal communication.
	Death from pneumonia one month after operation.	Autopsy:	Personal communication. History compiled by Dr. Reeves, of the New York Post-Graduate Hospital.
Child worse after each operation.	Not improved.	The operation wounds healed up readily.	Brit. Med. Journ., 1891. Vol. II., p. 949. Personal communication.
No improvement.	March 16, 1892, child still bad, total paraplegia; some evidence of tubercle in lung; died in nearly three months from tubercular meningitis.	Parts operated on almost healed and cavity evenly closed up.	Unpublished. Personal communication.

TABLE OF CASES.

Operation.	Region.	Duration of Disease.	Age and Sex.	Symptoms.	Operation.
70. Bowlby.	Upper dorsal.	About two years.	Five years. Male.	Gradually increasing paraplegia, six months becoming complete, with loss of patellar reflex; urine passed normally; ditto fæces.	Removal laminæ of second to fifth dorsal vertebræ.
71. Norman Porrett.	Lower cervical and upper dorsal.	Eighteen months.	Forty-one years. Female.	Severe nocturnal pain between shoulders and down arms, thence spreading down back to legs; twitchings of feet; loss of power in legs, with spasm "spastic paraplegia;" bed sores; incontinence of urine; slight but undoubted angular curve of the spine at the vertebra prominens.	Removal of laminæ of last cervical and two first dorsal vertebræ, and opening abscess in front of spinal membranes.
72. Urban.				Temporary resection.	
73. Urban.		Two years or more.	Female. Five years.	Temporary resection.	
74. Lloyd.	Dorsal.			Complete spastic paraplegia, anæsthesia; incontinentia alvi et urinæ; prevertebral abscess with sinus; sinus into pleural cavity; very angular curve; reflexes absent; apparently dying; operation undertaken as a last resort only when it was demonstrated that mechanical treatment was of no avail.	Removal arches eighth, ninth, tenth, eleventh and twelfth dorsal vertebræ; no pulsation in cord until removal of thickened fibrous bands at interspinous ligaments when dura expanded and filled canal; pulsation returned; canal probed above and below and found patent.
75. Israel.				Spondylitis with abscess and complete paralysis.	

TABLE OF CASES.

Subsequent Course.	Result.	Remarks.	Reference.
Healing by first intention; commencing return of power in eight days; walked in four months.	Cure.		Brit. Med. Journ., 1891, Vol. II., p. 947. Personal communication.
Death from hyperpyrexia eighteen hours after operation.	Death.	Caries of the bodies of last cervical and first dorsal vertebræ was found after death, the caries being confined to the posterior aspect of the bodies; the first two dorsal vertebræ were firmly anchylosed by bony union almost in a straight line; no trace of abscess cavity outside the spinal column; at first sight the case appeared one of tabetic change in the spinal cord, and the almost total absence of local signs at a point where prominence of the spine is looked for was misleading.	Personal communication.
In both cases there was no pulsation in the membranes until the removal of the compressing portion of the vertebral bodies.	Death.		Beilage zum Centralblatt für Chirurgie, 1892. No. 32.
	Death.		Ibid.
Gradual improvement in paralysis and anæsthesia; operation not undertaken until child thought to be dying; general condition at first improved then bad again; before death anæsthesia re-established to a considerable degree, could raise left leg at right angles to bed; partial control over bladder and rectum.	Death from exhaustion, three weeks after operation.	Autopsy: Large kyphos composed of all the dorsal vertebræ: two sinuses to left of median line one communicating with pleural cavity the other with prevertebral abscess, separated by a very thin fibrous septum. Cord and membranes normal. Operation not undertaken until patient's recuperative powers exhausted.	
Considerable improvement, the legs can be actively raised. Improvement did not however set in until four months after the operation.	Improved.	Report received too late for use in the paper.	Beilage zum Centralblatt für Chirurgie, 1892. No. 32.